

Application No. 10/689,792  
Reply to Office action of April 3, 2007

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## REMARKS

Claims 1-110 were filed with the present application and were subject to a restriction requirement. The invention of Group I, claims 1-28 and 51-80 was elected, and claims 29-50 and 81-110 are now cancelled. Claims 13, 16, 63 and 66 were cancelled in a response dated 9 June 2006; claims 6, 7, 56, and 57 were cancelled, and new claims 110-128 were added in the previous response dated 8 January 2007. Claims 1-5, 8-12, 14, 15, 17-55, 58-62, 64-65, 67-80 and 110-128 are currently under consideration.

### Rejections under 35 USC §112

Claims 8 and 57 are rejected under 35 USC §112, second paragraph, as being indefinite, because both are dependent from cancelled claims. Claim 57 was cancelled in the previous response and claim 58 as originally presented depended from it. Claims 8 and 58 are now amended to depend from claim 1 and claim 51, respectively. It is believed that none of the pending claims are indefinite after entry of the amendment.

### Rejections under 35 USC §102

Claims 1-8, 14, 16-18, 20-22, 24-25, 27-28, 51-58, 64-65, 71-76, 78-80, 111-118, 120, 124-125 and 127-128 are rejected under 35 U.S.C. 102(b) as being anticipated by Hosokawa *et al.* (US 6,284,393). The rejection was maintained and the action made final despite Applicants' argument that the teachings of the reference had been mischaracterized in making the rejection. Applicants urge that a careful reading of the Hosokawa patent confirms that the reference cannot anticipate the claims, as all of the limitations thereof are not disclosed. A fuller exposition of the teachings of the reference is now presented:

The Hosokawa patent relates to organic light emitting (OEL) devices that include a "positive electrode, a negative electrode and an organic layer including an organic light-emitting layer as sandwiched between the two electrodes, in which the negative electrode is comprised of an electron injection electrode layer and an amorphous

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transparent conductive film, and in which the electron injection electrode layer is adjacent to the organic layer" (col. 5, lines 33-40). FIGS. 1-5 illustrate the "organic EL device of (1) to (5) of the invention," in which the negative electrode is limited to the electron injection electrode layer and the transparent conductive film (col. 4, lines 39-40, col. 5, lines 32-39, FIGS. 1-5). FIGS. 6-11 illustrate "the organic EL device of (6) to (13) of the invention" (col. 4, lines 40-41), in which the negative electrode includes a thin metal layer in addition to the electron injection electrode layer and amorphous transparent conductive film: (col. 13, line 28-39, FIGS. 6-11).

Hosokawa teaches that the electron injection layer of the 'organic EL device of (1) to (5)' may be composed of a discontinuous "island-like electron injection zone" (col. 9, line 64 - col. 10, line 60) and that the electron injection layer of the 'organic EL device of (6) to (13)' is the same as that of the 'organic EL device of (1) to (5)' (col. 15, lines 2-5). Devices containing a layer having an "island-like" discontinuous structure are illustrated in FIGS. 2 and 8 of the '393 patent, reproduced below. FIG. 2 shows substrate 1, positive electrode 2, organic light-emitting layer 3, "island-like" electron injection electrode layer 6 and amorphous transparent conducting film 5. FIG. 8 includes thin metal film 10 and thin transparent film 11 in addition to 1, 2, 3, 5 and 6. In the embodiment illustrated in FIG. 2, "the electron injection electrode layer and the amorphous transparent conductive film constitute the negative electrode" (col. 10, lines 36-38). FIG. 8 shows an embodiment of the 'organic EL device of (6) to (13),' "the negative electrode is comprised of an electron injection electrode layer, a transparent conductive film and a thin metal film" (col. 13, lines 28-34).

Fig. 2

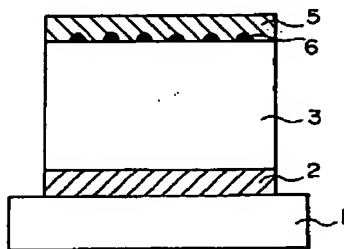
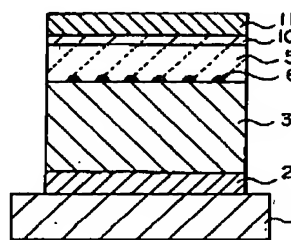


Fig. 8



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The electro-active devices of the present invention, require a first metal-containing layer comprising "at least one metal disposed in a plurality of domains forming a discontinuous layer on a surface of at least one of said first electrode and said second electrode" and the metal is "platinum, palladium, gold, silver, ruthenium, osmium, iridium, rhodium, copper, nickel" or a combination thereof" (claims 1 and 51).

The Office action states that "column 13, line 44-column 14, line 12 discloses that the thin metal film can be platinum or gold" (page 7, paragraph 15). With respect, Applicants point out that the passage cited refers to the thin metal film of the 'organic EL device of (6) to (13),' illustrated in FIG. 8 as structure 10, and not to the "island-like" electron Injection electrode layer (structure 6 in FIGS. 2 and 8). The island-like electron injection zone is composed of materials "having a low work function of not larger than 3.8 eV" (col. 10, lines 7-8). Metals and alloys for use therein include Mg, Ca, Ba, Sr, Li, Yb, Eu, Y, Sc, and aluminium-lithium alloys, magnesium-aluminium alloys, indium-lithium alloys, lead-lithium alloys, bismuth-lithium alloys, tin-lithium alloys, aluminium-calcium alloys, aluminum-barium alloys, and aluminum-scandium alloys (col. 10, lines 20-23, col. 8, lines 17-36, emphasis added). In contrast, the metals of the claimed metal-containing layer, platinum, palladium, gold, silver, ruthenium, osmium, iridium, rhodium, copper, and nickel, are high work function materials, having a work function of at least 4.5 eV, as shown in Table 4.17, reproduced from Lange's Handbook of Chemistry (15th Edition), Dean, J.A., ed. pages 4.80-4.81(1999)). Accordingly, Applicants submit that claims 1-5, 8-12, 14, 15, 17-55, 58-62, 64-65, 67-80 are not anticipated by Hosokawa. It is believed that the rejection is hereby overcome.

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**TABLE 4.17** Work Functions of the Elements

The work function  $\phi$  is the energy necessary to just remove an electron from the metal surface in thermoelectric or photoelectric emission. Values are dependent upon the experimental technique (vacua of  $10^{-9}$  or  $10^{-10}$  torr, clean surfaces, and surface conditions including the crystal face identification).

Element	$\phi$ , eV	Element	$\phi$ , eV
Ag	4.64	Eu	2.5
Al	4.19	Fe	4.65
As	(3.75)	Ga	4.25
Au	5.32	Ge	5.0
B	(4.75)	Gd	3.1
Ba	2.35	Hf	3.65
Be	5.08	Hg	4.50
Bi	4.36	In	4.08
C	(5.0)	Ir	5.6
Ca	2.71	K	2.30
Cd	4.12	La	3.40
Ce	2.80	Li	3.10
Co	4.70	Mg	3.66
Cr	4.40	Mn	3.90
Cs	1.90	Mo	4.30
Cu	4.70	Na	2.70

**TABLE 4.17** Work Functions of the Elements (Continued)

Element	$\phi$ , eV	Element	$\phi$ , eV
Nb	4.20	Si	4.85
Nd	3.1	Sm	2.95
Ni	5.15	Sn	4.35
Os	4.83	Sr	2.76
Pb	4.18	Ta	4.22
Pd	5.00	Tb	3.0
Po	4.6	Te	4.70
Pr	2.7	Th	3.71
Pt	5.40	Ti	4.10
Rb	2.20	Tl	4.02
Re	4.95	U	3.70
Rh	4.98	V	4.44
Ru	4.80	W	4.55
Sb	4.56	Y	3.1
Sc	3.5	Zn	4.30
Se	5.9	Zr	4.00

Source: S. Trasatti, *J. Chem. Soc. Faraday Trans. I* 68:229 (1972); N. D. Lang and W. Kohn, *Phys. Rev. B* 3:1215 (1971).

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### Rejections under 35 USC §103

Claims 9-12, 22-23, 59-62, 74 and 122-123 are rejected under 35 U.S.C. 103(a) as being obvious over Hosokawa *et al.* Claims 1, 19, 51, 70, and 119 are rejected under 35 U.S.C. 103(a) as being obvious over Hosokawa *et al.*, in view of Sakai, *et al.* (US 4,824,488). Claims 1, 22-23, 51, 73-74, and 122-123 are rejected under 35 U.S.C. 103(a) as being obvious over Hosokawa *et al.*, in view of Swirbel, *et al.* (US 5,460,922). The rejections are traversed.

The deficiencies of the Hosokawa reference are discussed above. Briefly, Hosokawa does not disclose a device having a layer wherein the claimed high work function metal(s) is(are) disposed in a plurality of domains forming a discontinuous layer. One of ordinary skill in the art would have no motivation to substitute the high work function metals of the claims for the low work function metals disclosed in the reference. As neither the Sakai patent nor the Swirbel patent supplies the deficiency, Applicants submit that the claims are not obvious over any of the references, singly or in combination.

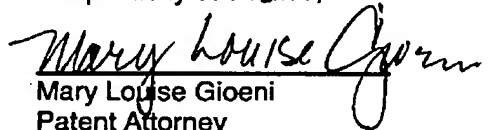
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In view of the foregoing amendment and for the reasons set out above, Applicants respectfully submit that the application is in condition for allowance. Favorable reconsideration and prompt allowance of the application are respectfully requested.

Should the Examiner believe that anything further is needed to place the application in condition for allowance, the Examiner is requested to contact Applicants' undersigned representative at the telephone number below.

Respectfully submitted,

  
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